Claims

1. A grain drill comprising:

a frame having a plurality of wheels for supporting the grain drill during rolling over a surface of ground to be planted with grain;

a hopper for containing the seed grain to be planted in the ground;

a support which is joined to opposed sides of the frame and to spaced apart locations of the hopper to transfer weight of the hopper to the frame, the support including at least one weight sensing device which senses a weight of seed grain in the hopper transferred through the support to the frame and provides an output of the sensed weight of the seed grain in the hopper; and

a display, coupled to the output, for displaying the weight of the seed grain contained in the hopper.

2. A grain drill in accordance with claim 1 wherein the support comprises:

a pair of weight bearing supports which are respectively joined to the opposed sides of the frame, each weight bearing support including first and second vertical parts which are respectively attached to the hopper at the spaced apart locations separated along a longitudinal dimension of the grain drill and a horizontal part joined to the vertical parts and attached to the frame.

3. A grain drill in accordance with claim 2 wherein:

the at least one weight sensing device comprises first and second load cells associated with each of the pair of weight bearing supports, the first load cell being loaded with weight transferred from the first vertical part to the horizontal part and the second load cell being loaded with weight transferred from the second vertical part to the horizontal part.

4. A grain drill in accordance with claim 3 wherein:

a first end of the first and second vertical parts is attached to the hopper and a second end of the first and second vertical parts is respectively attached to spaced apart locations of the horizontal part to transfer the weight of the seed grain in the hopper to the horizontal part; and

the horizontal part has first and second horizontal extensions, the first horizontal extension having a first end which is coupled to the frame and includes the first load cell and a second end which is deflected downward by the weight of the seed grain in the hopper and which is attached to the second end of the first vertical part and the second horizontal extension having a first end which is coupled to the frame and includes the second load cell and a second end which is deflected downward by the weight of the seed grain in the hopper and which is attached to the second end of the second vertical part.

5. A grain drill in accordance with claim 4 wherein:

the support frame includes at each of the opposed sides a horizontal member, each horizontal member having at least first and second spaced apart holes extending vertically through the horizontal member and which respectively receive and allow vertical movement of a portion of the first and second vertical parts therein, the holes restricting horizontal movement of the hopper relative to the frame by confining the portion of the first and second vertical parts to within the holes.

6. A grain drill in accordance with claim 5 wherein the first and second vertical parts comprise:

a horizontal piece attached to one end of a vertical piece and another end of the vertical piece being the second end of the vertical part, at least one connector extending from the horizontal piece and through one of the holes and being vertically moveable therein and into engagement with the hopper.

7. A grain drill in accordance with claim 6 wherein:

a pair of connectors extend from the horizontal piece at opposed ends thereof spaced from a point of attachment of the vertical piece to the horizontal piece.

8. A grain drill in accordance with claim 6 wherein:

each connector is threaded and engages threads in the hopper at one of the spaced apart positions of the hopper.

9. A grain drill in accordance with claim 7 wherein:

the pair of connectors are threaded and respectively engage threads in the hopper at one of the spaced apart positions of the hopper.

10. A grain drill in accordance with claim 6 wherein:

a bushing is located in each hole and securely engages each connector to prevent horizontal movement of the engaged connector relative to the bushing.

11. A grain drill in accordance with claim 7 wherein:

a bushing is located in each hole and securely engages each connector to prevent horizontal movement of the engaged connector relative to the bushing.

12. A grain drill in accordance with claim 8 wherein:

a bushing is located in each hole and securely engages each connector to prevent horizontal movement of the engaged connector relative to the bushing.

13. A grain drill in accordance with claim 9 wherein:

a bushing is located in each hole and securely engages each connector to prevent horizontal movement of the engaged connector relative to the bushing.

14. A grain drill in accordance with claim 1 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

15. A grain drill in accordance with claim 2 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

16. A grain drill in accordance with claim 3 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

17. A grain drill in accordance with claim 4 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

18. A grain drill in accordance with claim 5 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

19. A grain drill in accordance with claim 6 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

20. A grain drill in accordance with claim 7 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

21. A grain drill in accordance with claim 8 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

22. A grain drill in accordance with claim 9 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

23. A grain drill in accordance with claim 10 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

24. A grain drill in accordance with claim 11 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

25. A grain drill in accordance with claim 12 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

26. A grain drill in accordance with claim 13 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

27. A grain drill in accordance with claim 2 wherein:

each weight bearing support is mounted to not extend in a direction along a width of the grain drill beyond a width of a portion of the frame to which the weight bearing support is attached.

28. A grain drill in accordance with claim 2 wherein:

at least one weight bearing support has at least a part extending in a direction along a width of the grain drill part extending beyond a width of a portion of the frame to which the weight bearing support is attached.

29. A method for modifying a grain drill having a frame having a plurality of wheels for supporting the grain drill during rolling over a surface of ground to be planted with seed grain and a hopper joined to the frame for containing the seed grain to be planted comprising:

raising the hopper upward from the frame to separate the hopper from being joined to the frame;

positioning a support between the hopper and the frame to join the support to opposed sides of the frame and to spaced apart positions of the hopper to support the hopper in a raised position above the frame, the positioned support transferring weight of the hopper to the frame and including at least one weight sensing device which senses a weight of the seed grain in the hopper transferred through the support to the frame and which provides an output of the sensed weight of the seed grain in the hopper; and

providing a display on the grain drill for displaying the weight of the seed grain contained in the hopper.

30. A method in accordance with claim 29 wherein the support comprises:

a pair of weight bearing supports which are respectively joined to the opposed sides of the frame, each weight bearing support including first and second vertical parts which are respectively attached to the hopper at the spaced apart locations separated along a longitudinal dimension of the grain drill and a horizontal part joined to the vertical parts and attached to the frame.

31. A method in accordance with claim 30 wherein:

the at least one weight sensing device comprises first and second load cells associated with each of the pair of weight bearing supports, the first load cell being loaded with weight transferred from the first vertical part to the horizontal part and the second load cell being loaded with weight transferred from the second vertical part to the horizontal part.

32. A method in accordance with claim 31 wherein:

a first end of the first and second vertical parts is attached to the hopper and a second end of the first and second vertical parts are respectively attached to spaced apart locations of the horizontal part to transfer the weight of the seed grain in the hopper to the horizontal part;

the horizontal part has first and second horizontal extensions, the first horizontal extension having a first end which is coupled to the frame and includes the first load cell and a second end which is deflected downward by the weight of the seed grain in the hopper and which is attached to the second end of the first vertical part and the second horizontal extension having a first end which is coupled to the frame and includes the second load cell and a second end which is deflected downward by the weight of the seed grain in the hopper and which is attached to the second end of the second vertical part.

33. A method in accordance with claim 32 wherein: the support frame includes at each of the opposed sides a horizontal member, each horizontal member having at least first and second spaced apart holes extending vertically through the horizontal member and which respectively receive and allow vertical movement of a portion of the first and second vertical parts therein, the holes restricting horizontal movement of the hopper relative to the frame by confining the portion of the first and second vertical parts to within the holes.

34. A method in accordance with claim 33 wherein: a horizontal piece attached to one end of a vertical piece and another end of the vertical piece being the second end of the vertical part, at least one connector extending from the horizontal piece and through one of the holes and being vertically moveable therein and into engagement with the hopper.

35. A method in accordance with claim 34 wherein: a pair of connectors extend from the horizontal piece at opposed ends thereof spaced from a point of attachment of the vertical piece to the horizontal piece.

36. A method in accordance with claim 35 wherein: the pair of connectors are threaded and respectively engage threads in the hopper at one of the spaced apart positions of the hopper.

37. A method in accordance with claim 35 wherein: a bushing is located in each hole and securely engages each connector to prevent horizontal movement of the engaged connector relative to the bushing.

38. A method in accordance with claim 36 wherein:

a bushing is located in each hole and securely engages each connector to prevent horizontal movement of the engaged connection relative to the bushing.

39. A grain drill in accordance with claim 29 wherein:

the spaced apart locations are located at four corners of the hopper and the support is attached to the four corners by engagement with a bottom part of the hopper.

40. A grain drill in accordance with claim 29 wherein:

each weight bearing support is mounted to not extend in a direction along a width of the grain drill beyond a width of a portion of the frame to which the weight bearing support is attached.

41. A grain drill in accordance with claim 29 wherein:

at least one weight bearing support has at least a part extending in a direction along a width of the grain drill part extending beyond a width of a portion of the frame to which the weight bearing support is attached.